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75TH MORSS

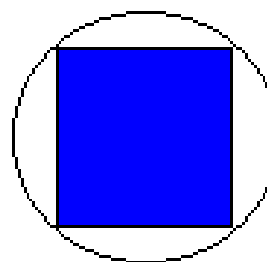
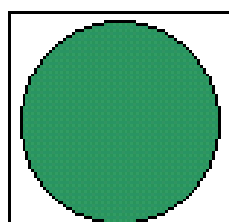
US Naval Academy
Annapolis, Maryland

June 12-13-14 2007

Through Multiple Disciplines, Analytical Power

Working Group 28 – Decision Analysis

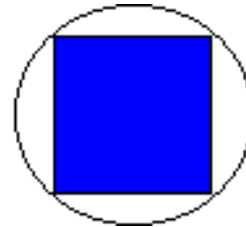
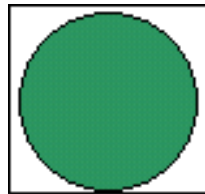
About Round Pegs and Square Holes ...



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The Problem

Does a square peg fit better into a round hole or does a round peg fit better into a square hole? Why are we trying to fit these together?



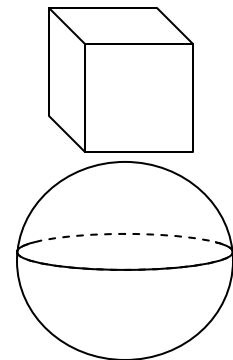
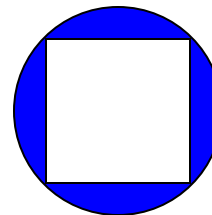
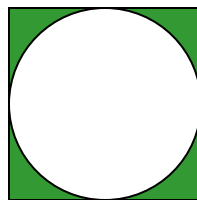
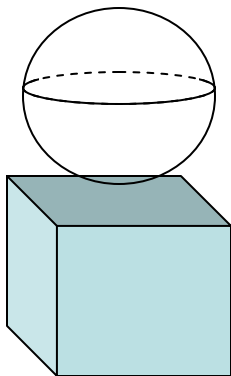
- At times, human beings attempt to fit the wrong solution to complicated problems
- Their solution *MUST* be the one
- A significant amount of time, effort and other resources are devoted to this undertaking
 - If the problem (*hole*) is larger than the solution (*peg*) attempted, parts of the problem would not be solved
 - If the problem is smaller than the solution attempted, there would be some wasted use of the solution – the problem would be solved under suboptimal application of the solution.
- Many times there is a tendency to fit relatively small problems into large solution tools, and vice-versa

Agenda

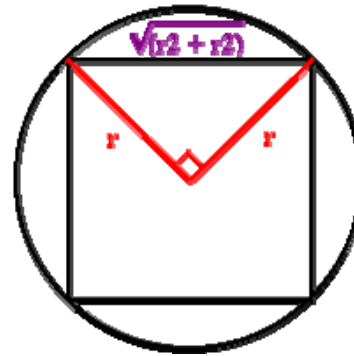
- This lecture attempts to highlight a discussion of common practices based on the Influence of Social And Behavioral Elements on Legacy Linear Analyses.
- Utilizing the well-known phrase "you can't fit a square peg in a round hole" or "you can't fit a round peg in a square hole" and "mathematizing" it, we would attempt to set the stage to discuss which one gives us less uncovered area.
- With this in mind we would look at recent attempts at solving large problems by using less than optimal solutions, and solving relatively small problems with large mathematical models
- We will also discuss possible social and behavioral elements and drivers, and the potential implications of these practices.

Getting Started

- Perhaps the difficult part of this, or any problem is getting started. How can you decide that one is better than the other? This might lead to some useful discussions.
- The first step is to define "fits better".
 - This can be connected to the "*uncovered space*" after the peg is fitted.
 - May be best expressed as a percentage of the larger shape. This is because the answer is then a ratio that is independent of the size of the objects.



Square Peg In Round Hole?



- Now if the radius of the circle is r , then by Pythagoras' Theorem, the side of the square is

$$\sqrt{r^2 + r^2} = \sqrt{2r^2} = r\sqrt{2}$$

- Hence the area of the square is

$$r\sqrt{2} \times r\sqrt{2} = 2r^2$$

- And the area of the circle is

$$\pi r^2$$

Compare The Areas

- Now we may subtract the area of the square from the area of the circle to find the wasted area.

$$\pi r^2 - 2r^2 = (\pi - 2)r^2$$

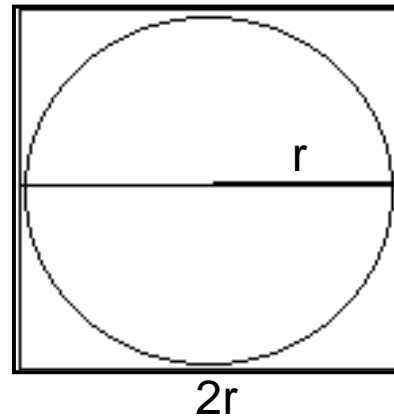
- The percentage wasted is the ratio of this difference over the area of the circle

$$\frac{(\pi - 2)r^2}{\pi r^2} = \frac{(\pi - 2)}{\pi} \approx 36.34\%$$

- Alternatively we could look at the ratio: $\frac{\text{(area of the square)}}{\text{(area of the circle)}}$

$$\frac{2r^2}{\pi r^2} = \frac{2}{\pi} \approx 63.66\% \text{ of circular area covered by the square}$$

Round Peg In Square Hole?



- The area of the circle is πr^2
- From the diagram, the side length of the square is $2r$. Hence the area of the square is

$$(2r)^2 = 4r^2$$

Compare The Areas

- Now we may subtract the area of the circle from the area of the square to find the wasted area.

$$4r^2 - \pi r^2 = (4 - \pi)r^2$$

- The percentage wasted is the ratio of this difference over the area of the circle

$$\frac{(4 - \pi)r^2}{4r^2} = \frac{(4 - \pi)}{4} \approx 21.46\%$$

- Alternatively we could look at the ratio: $\frac{\text{area of the circle}}{\text{area of the square}}$

$$\frac{\pi r^2}{4r^2} = \frac{\pi}{4} \approx 78.54\% \text{ of square area covered by the circle}$$

In Summary

- The circle covers more of the square than the square does the circle
- Therefore, it is better to be a round peg in a square hole than a square peg in a round hole
- In our analogy to problem solving it would be intuitive to assume that a solution which give you less uncovered area would be better than the alternative
- However our interest is to look into the uncovered area and select what items were not covered by our solution
- Let's explore the Influence of Social And Behavioral Elements on Legacy Linear Analyses

Defining Legacy Linear Analyses

- By moving only ONE coin, could you place four coins in both directions (left-to-right and top-to-bottom) ...?

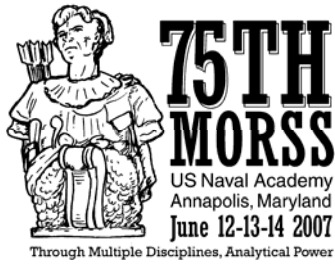


Defining Legacy Linear Analyses

- By moving only ONE coin, could you place four coins in both directions (left-to-right and top-to-bottom) ...?



- We have the tendency to think in two dimensions or in linear relationships



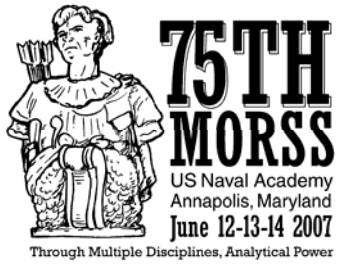
Social and Behavioral Elements



- Recent analyses emphasize evaluation of activities by certain groups of individuals, e.g.:
 - Recruiting
 - GWOT
 - IEDs
 - Personnel Rotation Policies
- Some data available is sparse
- Evaluations based on historical (past) performance
- Attempts concentrate on linear relationships to establish trends
- Not necessarily predictors of future performance

The Internal Influence

- Evaluation of these attributes proves to be cumbersome, to say the least
- *Legacy Linear Analysis* practices drive assumptions that fix past performance and assume it would not change
- Social and behavioral elements may prove to be countless, challenging to sort and assess their effectiveness, and too complex to establish correlations to the data if they exist
- However, if relationships exist among metrics under study with social and behavioral elements, and we are able to establish the same, our analysis would be more complete filling some of the “*uncovered space*”



More Internal Influence



- Social and behavioral elements may not be limited to the subject under study
- YOUR OWN elements
- YOUR TEAM's elements
- The relationship between the two

The External Influence

- Who is your target audience when you report the results of your analysis?
 - Junior to you
 - Senior to you
 - Piers
- Do you understand the social, cultural and behavioral elements of the individuals and their organization?
- How would you present your message?
- How would they receive your message?
- Understanding interests and motivations may add a positive dimension to your results

Dangers!

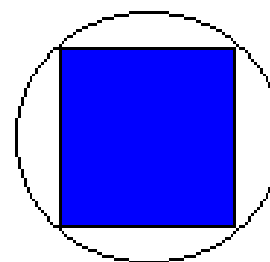
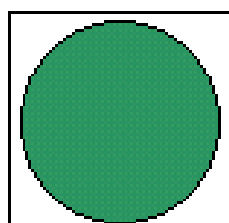
- Legality of the data used, its interpretation and conclusions reached based on this data
- Locking up to stereotypes
- Discriminatory assertions
- Pre-judged expectations



Conclusions

- It may be beneficial to consider human factors not only from the programmatics of human systems integration (HSI) point of view
- The influence of social and behavioral elements have played – and still play – a critical role in traditional analysis efforts
- Many times these are overlooked or not considered due to the complexity of the issues dealing with human behavior
- “Our interest is not necessarily to predict human behavior, but to compute – and attempt to influence – the probability of occurrence of future behavior-driven activities”
- Not a sermon, just some observations...

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However....

...a round peg fits better into a square hole than a square peg fits into a round hole result is true only in dimensions $n < 9$, and for $n \geq 9$, the unit n -hypercube fits more closely into the n -hypersphere than vice versa (Singmaster; Wells 1986, p. 74).

